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(72) LEE, Kyung-Sup, CA
(71) LEE, Kyung-Sup, CA

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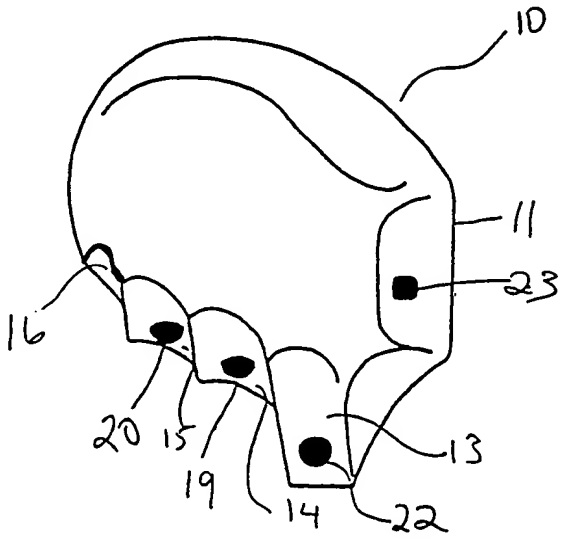
(54) **APPAREIL DE COMMANDE MANUELLE**
(54) **A MANUALLY OPERATED CONTROLLER APPARATUS**



(57) Appareil de commande manuelle comprenant un boîtier creux continu présentant plusieurs surfaces disposées de façon à réduire la fatigue musculaire de la main et du bras. La surface inclinée du boîtier permet à l'utilisateur de reposer sa main et son bras dans une position plus naturelle, réduisant ainsi la fatigue musculaire à ce niveau. Des sélecteurs-pression positionnés verticalement permettent aussi aux doigts de l'utilisateur de reposer dans une position plus détendue, tout en permettant un accès facile. Un sélecteur-pression situé sur la surface d'appui verticale du pouce agit comme commande de mise au point pour permettre à l'utilisateur de déplacer le curseur avec un mouvement minimal.

(57) A manually operated controller apparatus includes a continuous hollow housing with a plurality of surfaces that are arranged in such a way that hand and arm muscle fatigue are reduced. The tilted surface of the housing allows for the user's hand and arm to rest in a more natural position, thereby reducing fatigue experienced in the arm and hand muscles. The vertically positioned depressible switches also allow the user's fingers to rest in a more relaxed position while allowing for easy access to the switches. A depressible switch located on the vertical thumb support surface acts as a fine tuner allowing the user to move the cursor minimum displacements.

A MANUALLY OPERATED CONTROLLER APPARATUS

Abstract

A manually operated controller apparatus includes a continuous hollow housing with a plurality of surfaces that are arranged in such a way that hand and arm muscle fatigue are reduced. The tilted surface of the housing allows for the user's hand and arm to rest in a more natural position, thereby reducing fatigue experienced in the arm and hand muscles. The vertically positioned depressible switches also allow the user's fingers to rest in a more relaxed position while allowing for easy access to the switches. A depressible switch located on the vertical thumb support surface acts as a fine tuner allowing the user to move the cursor minimum displacements.

Description

A MANUALLY OPERATED CONTROLLER APPARATUS

Field of Invention

This invention relates in general to hand controllers and more particularly to a manually operated controller apparatus for reducing hand muscle and arm muscle fatigue.

Background of the Invention

Prolonged use of a hand controller or computer mouse causes the muscles of the hand and the arm to become fatigued. Fatigue and stress in the user's hand and arm are caused by the current designs of hand controllers. These hand controllers often have the buttons horizontally mounted so that the buttons are pressed from the top down. Since the buttons are right under the user's fingers, the buttons can inadvertently be pressed if the user's fingers relax and rest on the buttons. As a result, there is a constant and unconscious effort by the user to keep their fingers off the buttons. This effort must be maintained during prolonged use of the hand controller. As a result, the user's hand and arm muscles become fatigued and stressed while sustaining this unconscious effort.

Contributing to the hand and arm muscle fatigue, is the stress on the user's arm from being in an unnatural position while operating the hand controller. The various designs of current hand controllers usually require the users to twist their arm into an unnatural position to be able to grasp and operate the hand controller. The twisting occurs because most hand controllers do not allow the user's palm to rest in the horizontal plane in a natural position.

Another problem associated with hand controllers, is the inability to accurately position the associated cursor when altering the information displayed on the display device of a computer. This problem is particularly apparent when the required movement is a minimum displacement.

Prior art hand controllers have been devised to address the aforenoted problems. For example, U.S. patent No. 5,287,090 issued February 15, 1994, relates to a combined mouse and track ball contained within an ergonomically shaped housing that fits the palm of the

hand. U.S. patent No. 5,252,970 issued October 12, 1993, relates to a manually operated ergonomic multi-axis controller such as those used for controlling the cursor position along x and y axes and for entering the x, y, and/or z coordinate information into a computer or the like.

U.S. patent No. 5,157,381 issued on October 20, 1992, relates to a computer mouse with a unique button information which enhances button flexibility while remaining user friendly. U.S. patent No. 4,862,165 issued August 29, 1989, relates to an ergonomically shaped mouse that reduces fatigue.

U.S. patent No. 4,595,070 issued on June 17, 1986, relates to a housing for a computer mouse device which supports the mouse above a working surface on a cushion of air or other gaseous fluid. U.S. patent No. 4,550,316 issued October 29, 1985, relates to a housing with sliding movement on a nonspecific work surface, and a stylus depending from the housing and contacting the work surface.

Thus a hand controller device which would reduce hand and arm muscle fatigue is desirable.

Summary of the Invention

An object of the present invention is to provide an improved hand controller apparatus.

In accordance with one aspect of the present invention there is provided a manually operated controller apparatus, for reducing hand muscle and arm muscle fatigue, comprising of a continuous hollow housing having a plurality of integrally arranged surfaces. The surfaces consist of a tilted arched palm support surface to reduce the twisting of the lower arm, a sloping concave index finger support surface, a concave middle finger surface, a concave ring finger surface, a concave little finger support surface, a vertical concave thumb support surface, and a substantially planar member enclosing the housing.

Preferably, the manually operated controller apparatus will have a downwardly tilted arched palm support surface that will reduce hand and arm muscle fatigue.

Conveniently, the manually operated controller apparatus will comprise of depressible switches on the sloping concave index finger support surface, the concave middle finger surface, the concave ring finger surface, and the vertical concave thumb support surface.

Preferably the depressible switch on the vertical concave thumb support surface will be a fine tuner that is movable along orthogonal directions.

Advantages of the present invention are: the tilted arched palm support surface to reduce hand and arm muscle fatigue; vertically placed buttons which allow the user's fingers to hang in a more relaxed position; and a fine tuner button which will allow for the accurate positioning of the cursor when minimum displacement of the cursor is required.

Brief Description of the Drawings

A detailed description of the preferred embodiment is provided herein below with reference to the following drawings, in which:

Figure 1, in a front plan view, illustrates a manually operated controller apparatus in accordance with the preferred embodiment of the present invention.

Figure 2, in a top plan view, illustrates the manually operated controller apparatus of Figure 1.

Figure 3, in a right side view, illustrates the manually operated controller apparatus of Figure 1.

Figure 4, in a left side view, illustrates the manually operated controller apparatus of Figure 1.

Figure 5 is one example of the fine tuning circuitry.

In the drawings, preferred embodiments of the invention are illustrated by way of example. It is to be expressly understood that the description and drawings are only for the

purpose of illustration and as an aid to understanding, and are not intended as a definition of the limits of the invention.

Detailed Description of the Preferred Embodiment

Referring to Figures 1 and 2, there is illustrated in a front plane view and a top plan view, a manually operated controller apparatus 10 in accordance with the preferred embodiment of the present invention. The manually operated controller apparatus 10 includes a continuous hollow housing 11 having a plurality of surfaces comprising of a tilted arched palm support surface 12 to reduce twisting of the lower arm, a sloping concave index finger support surface 13, a concave middle finger surface 14, a concave ring finger surface 15, a concave little finger support surface 16 and a vertical concave thumb support surface 17. The housing 11 is enclosed by a substantially planar member 18. The manually operated controller apparatus 10 has a tilted arched palm support surface 12 that is tilted downwardly from the horizontal plane at an angle "a" or range between 20 to 35 degrees.

The manually operated controller apparatus 10 further comprises of two vertically positioned depressible switches 19 and 20 on the concave middle finger surface 14 and the concave ring finger surface 15, respectively. A depressible switch 22 is positioned on the sloping concave index finger support surface 13. The manually operated controller apparatus 10 further comprises of a depressible switch 23 positioned on the vertical concave thumb support surface 17.

In Figures 3 and 4, the manually operated controller apparatus 10 is illustrated in right and left side views respectively. Figure 3 illustrates the manually operated controller apparatus 10 and all of its features as described in Figures 1 and 2. The manually operated controller apparatus 10 further comprises of a concave little finger support surface 16 that allows the little finger to rest comfortably while the manually operated controller apparatus 10 is being used as indicated in Figure 3 by the smooth curved lines. The sloping concave index finger support surface 13 is disposed relative to the tilted arched palm support surface 12 at an obtuse angle "b". The tilted arched palm support surface 12 allows the user's back portion of the palm to comfortably rest on the table or mouse pad at an angle "c" as indicated by the smooth curved lines in Figure 2.

Figure 4 illustrates the manually operated controller apparatus 10 and all of its features as described in Figures 1 and 2. The manually operated controller apparatus 10 further comprises of the depressible switch 23 positioned vertically on the concave thumb support surface 17. The depressible switch 23 can be used as a fine tuner that is movable along orthogonal directions.

In operation, the manually operated controller apparatus 10 can reduce hand muscle and arm muscle fatigue. How this is achieved is explained hereinbelow with reference to Figures 1-4. The continuous hollow housing 11 comprises of a plurality of integrally arranged surfaces that consist of a tilted arched palm support surface 12, a sloping concave index finger support surface 13, a concave middle finger surface 14, a concave ring finger surface 15, a concave little finger support surface 16 and a vertical concave thumb support surface 17.

These surfaces are arranged in such a way that the user's palm, fingers and arm are supported so as to reduce muscle fatigue in the hand and arm. In particular, the tilted arched palm support 12 is tilted downwardly from the horizontal plane at an angle "a" that allows the user's hand posture to be in as natural position as possible. This position reduces the amount of hand muscle and arm muscle fatigue the user experiences, since the user's lower arm does not have to rotate or twist from its natural position. The arrangement of these surfaces also allows for the user's fingers to rest in a natural and relaxed position.

The depressible switches 19 and 20 are positioned vertically on the concave middle finger surface 14 and the concave ring finger surface 15 respectively. This allows the user's fingers to rest or hang in a relaxed position, yet remain in a ready position to easily trigger the depressible switches 19 and 20. Finally, a depressible switch 23 on the vertical concave thumb support surface 17 is movable by the user along orthogonal directions. Depressible switch 23 acts as a fine tuner, which allows the user to move the cursor a minimum displacement on a display device associated with a computer. The hollow housing 11 is enclosed by a substantially planar member 18 which is removable to provide selective access to the interior of the housing 11 where a microprocessor and an electronic circuit design are housed.

Generally speaking the cursor movement controlled by a computer mouse or hand controller is usually determined by two pairs of train of pulses (one pair for horizontal, and the other for vertical movement) that are generated by the motion of the mouse in a manner well known by those persons skilled in the art. Each pulse causes the cursor to move a minimum displacement, and the direction of the movement is determined by the relative phase of a pulse train in relation to its companion pulse train (90 degrees lead or lag) which is determined by the direction of the mouse movement.

It is not uncommon for a user of a mouse to experience difficulties in moving a mouse over an incremental distance when the cursor needs to be moved or displaced by an extremely small distance. Accordingly, a fine tuner button 23 is provided at the vertical concave thumb support surface 17. When it is pushed in an orthogonal direction (*i.e.* either left/right and/or up/down), it will produce a pulse or pulses equivalent to those which would be produced by the motion of the mouse in the same direction. The pulses generated by this button may be either a single pulse per push, or a series or pulses (if the button is kept pushed for an extended period of time) at a relatively low rate which is equivalent to a slow motion of the mouse. This will allow the user to move the cursor an incremental distance without moving the mouse. One example of accomplishing the fine tuning feature of this invention is shown in Figure 5, although other circuits could be used with the manually operated controller apparatus described herein.

The circuitry to the right of the dashed line of Figure 5 represents circuitry normally found in prior art mouses. The circuitry includes power supply PS from a computer to power a processor, light emitting diodes LED and photo transistors Q11, Q12, Q13 and Q14. A small disc having radial slots is disposed between each LED and photo transistor. As the cursor is moved, the small disc between each LED and photo transistor rotates thereby causing the light travelling from the LED to the photo transistor to be intermittently interrupted, which causes the photo transistor to emit a pulse current in a manner well known in the art. The photo transistor will produce a current when excited by light from the LED, and will produce a nil current when light is blocked by the discs. Accordingly, a square wave pulse train is produced by each photo transistor. One pair, Q11 and Q12, and another pair Q13 and Q14, will each produce a pair of pulse trains. One pulse train of a pair is always out of phase by 90 degrees, either leading or lagging in relation to the other pulse

train of a pair, depending on the direction the mouse is moved. The new circuitry added to the mouse is shown to the left of Figure 5.

When the fine tuner button 100 is not pushed, all of the Z3 inputs as well as its output remain low, causing the Q3 to conduct and consequently all LEDs to be on, and the optical pulse generator is enabled. The optical pulse generator consists of pairs of LED with pairs of photo transistors Q11 and Q12 and pairs of LED with pairs of photo transistors Q13 and Q14.

At the same time, the inputs Z32 and Z34 as well as their outputs will also remain low. Since the outputs of these are the gate inputs to the NAND gates Z11 through Z14, the outputs of the NAND gates remain high, which cause Q21 through Q24 to be open, rendering the internal pulse generator ineffective.

When the fine tuner button 100 is pushed in any direction, one of the inputs to the Z3 as well as its output will go high causing Q3 to open Consequently the LEDs will be turned off. The photo-transistors Q11 through Q14 will remain open, thereby the optical pulse generating section to the right of the dashed lines of Figure 5 is disabled, rendering the normal motion of the mouse ineffective.

At the same time, depending on the direction toward which the fine tuner button 100 in pushed, one of the inputs to either Z32 or Z34 (or both if direction is diagonal) as well as its (or their) output(s) will go high, enabling either pair of the NAND gates Z11 and Z12, or Z13 and Z14 (or both). Then the enabled pair of the gates will pass the pulses from the internal pulse generator to their outputs which, in turn, turns the respective transistor pair Q21 and Q22, or Q23 and Q24 on and off, simulating the optical pulse generator.

The direction of the movement is determined by the relative phase of a pulse train (90 degrees leading or lagging) in relation to its companion pulse train, and the simulation is implemented as described below.

The fine tuning circuitry includes a frequency oscillator OSC generating a square pulse train as marked by OSC. The oscillator includes a variable resistor VR to adjust the frequency of the pulses.

As an example, if the fine tuner button 100 is pushed upward, that is the button U is pressed while the gate Z13 receives the pulse train from flip flap FF1-Q, Z14 receives the pulse train from flip flap FF2-Q through Z23, the phase of which is 90 degree lagging with respect to that of flip flap FF1-Q. However, if the fine tuner button 100 is pushed downward, that is the button D is pressed, Z14 will receive the pulse train from FF2-Q through Z24, the phase of which is 90 degrees leading with respect to that of FF1-Q. It works the same way for horizontal movement as well.

While the buttons U and D (or L and R) cannot be pressed at the same time, it is possible to press two buttons, one for horizontal and the other for vertical movement, if the fine tuner button 100 is pushed diagonally.

As long as the fine tuner button 100 is kept pushed in a direction, the cursor will continue moving to that direction. The speed of the cursor movement (the pulse rate) is adjustable by the setting of the variable resistor VR on the oscillator OSC which determines the frequency of the pulses.

The advantage of this method is that the mouse is compatible with any existing mouse, requiring no modification to the driver. However, various alternative methods are conceivable.

In summary, a manually operated controller apparatus is provided with improved design for reducing hand muscle and arm muscle fatigue.

Other variations and modifications of the invention are possible. All such modifications or variations are believed to be within the sphere and scope of the invention as defined by the claims appended hereto.

The emodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A manually operated controller apparatus, for reducing hand and arm muscle fatigue, comprising:
   (a) a continuous hollow housing having a plurality of integrally arranged surfaces, the surfaces comprising:
      (i) a tilted arched palm support surface to reduce the twisting of the lower arm;
      (ii) a sloping concave index finger support surface;
      (iii) a concave middle finger surface;
      (iv) a concave ring finger surface;
      (v) a concave little finger support surface;
      (vi) a vertical concave thumb support surface; and
   (b) a substantially planar member enclosing said housing.

2. A manually operated controller apparatus as claimed in claim 1 wherein said tilted arched palm support surface is tilted downwardly from the horizontal plane a range of between 20 to 35 degrees.

3. A manually operated controller apparatus as claimed in claim 1 further comprising a depressible switch positioned vertically on said concave middle finger surface.

4. A manually operated controller apparatus as claimed in claim 1 further comprising a depressible switch positioned vertically on said concave ring finger surface.

5. A manually operated controller apparatus as claimed in claim 1 further comprising a depressible switch positioned on said sloping concave index finger support surface.

6. A manually operated controller apparatus as claimed in claim 5 wherein said sloping concave index finger support surface is disposed relative said tilted arched palm support surface at an obtuse angle.

7. A manually operated controller apparatus as claimed in claim 1 further comprising a depressible switch positioned on said vertical concave thumb support surface.

8. A manually operated controller apparatus as claimed in claims 3, 4, 5, or 6 further comprising a fine tuner depressible switch positioned on said vertical concave thumb support surface.

9. A manually operated controller apparatus as claimed in claim 8 wherein said fine tuner depressible switch is movable in multiple directions.

10. A manually operated controller apparatus as claimed in claim 9 wherein said fine tuner depressible switch is movable along orthogonal directions.

11. A manually operated controller apparatus, for reducing hand and arm muscle fatigue, comprising:

(a) a continuous hollow housing having a plurality of integrally arranged surfaces, the surfaces comprising:

(i) a tilted arched palm support surface to reduce the twisting of the lower arm;

(ii) a sloping concave index finger support surface disposed relative said arched palm support surface at an obtuse angle;

(iii) a concave middle finger surface having a vertically mounted depressible switch;

(iv) a concave ring finger surface having a vertically mounted depressible switch;

(v) a concave little finger support surface;

(vi) a vertical concave thumb support surface; and

(b) a substantially planar member enclosing said housing;

12. A manually operated controller apparatus as claimed in claim 11, wherein said arched palm support is tilted downwardly from the horizontal plane a range of between 20 to 35 degrees.

13. A manually operated controller apparatus as claimed in claim 11 comprising a fine tuner depressible switch positioned on said vertical concave thumb support.

14. A manually operated controller apparatus as claimed in claim 13 wherein said fine tuner depressible switch is movable along orthogonal directions.

15. A manually operated controller apparatus as claimed in claim 11 comprising a means for removably securing said planar member to said housing so as to provide selective access to the interior of said housing.

16. A manually operated controller apparatus as claimed in claim 11 wherein said apparatus enables a user to interact with information displayed on a display device associated with a computer.

17. A computer mouse, for reducing hand and arm muscle fatigue, enabling a user to interact with information displayed on a display device associated with a computer comprising:

(a) a continuous hollow housing having a plurality of integrally arranged surfaces, the surfaces comprising:

(i) a tilted arched palm support surface to reduce the twisting of the lower arm;

(ii) a concave index finger support surface sloping downwardly from said tilted arched palm support surface at an obtuse angle;

(iii) a concave middle finger surface;

(iv) a concave ring finger surface;

(v) a concave little finger support surface;

(vi) a vertical concave thumb support surface;

(b) a substantially planar member enclosing said housing;

(c) a means for removably securing said planar member to said housing so as to provide selective access to the interior of said housing; and

(d) a microprocessor and an electronic circuit design housed on the interior of said mouse.

18. A computer mouse as claimed in claim 17, comprising a fine tuner depressible switch positioned on said vertical concave thumb support.

19. A computer mouse as claimed in claim 18, wherein said fine tuner depressible switch is movable along orthogonal directions.

FIGURE 1

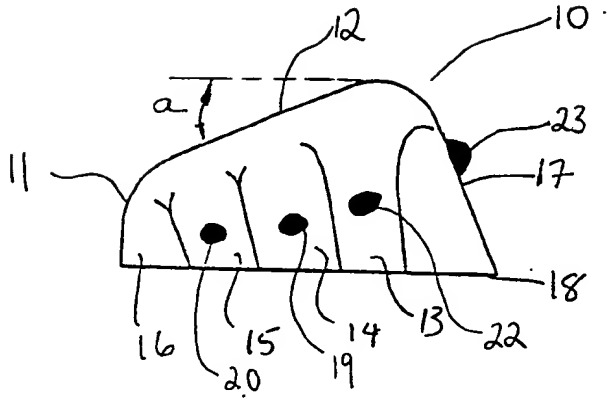


FIGURE 2

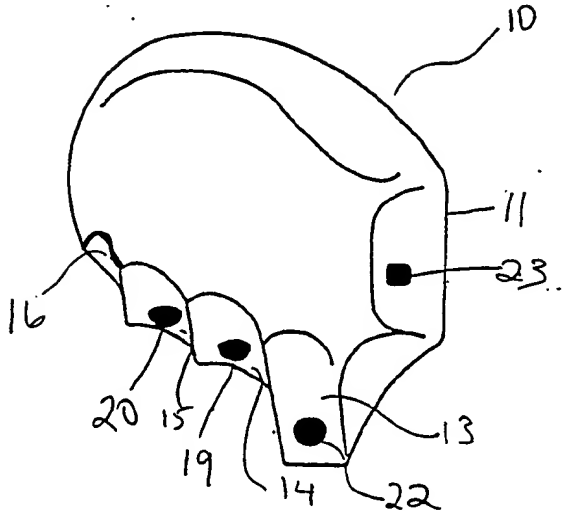


FIGURE 3

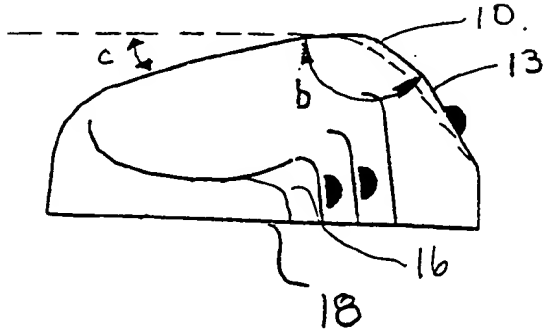


FIGURE 4

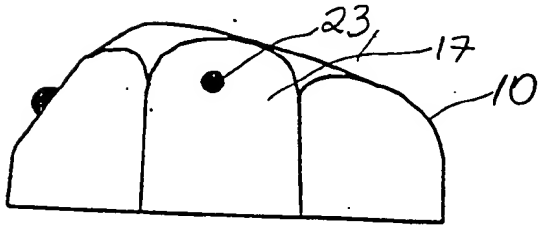
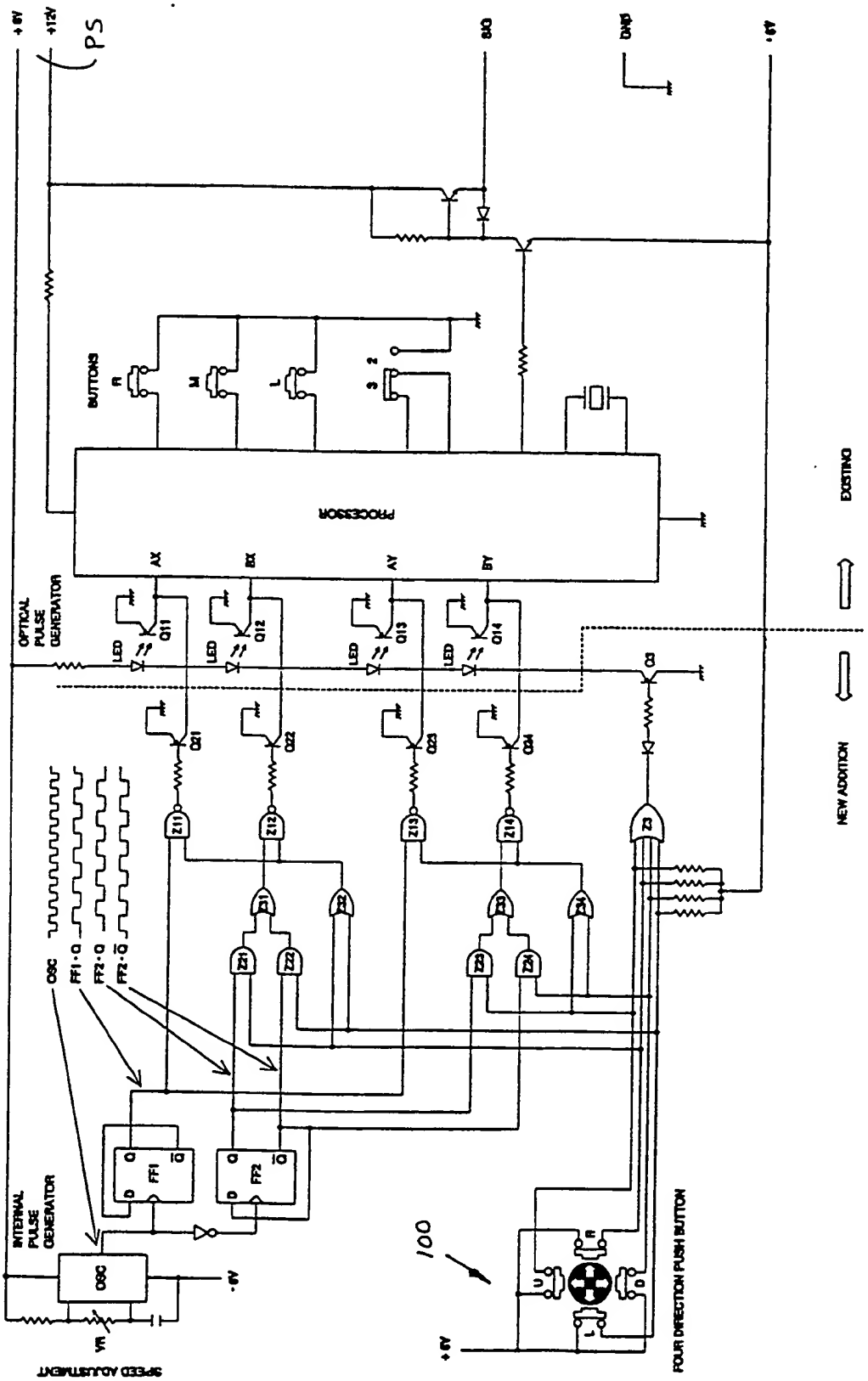


FIGURE 5


+5V
+12V
PS
GND
BUTTONS
R
M
L
PROCESSOR
AX
BX
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BY
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LED
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Q12
Q13
Q14
D1
D2
D3
D4
D
Z11
Z12
Z13
Z14
Z3
Z1
Z2
Z21
Z22
Z23
Z24
Z4
OSC
FF1·Q
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FF2·Q̄
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FF2
Q
Q̄
D
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VR
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100
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FOUR DIRECTION PUSH BUTTON
EXISTING
NEW ADDITION